

TWO NEW SPECIES OF *LIATRIS* SERIES *PUNCTATAE*  
(ASTERACEAE: EUPATORIEAE) CENTERED IN  
NORTH CENTRAL TEXAS

G.L. Nesom and R.J. O'Kennon

*Botanical Research Institute of Texas*  
509 Pecan Street  
Fort Worth, TX 76102-4060, U.S.A.

ABSTRACT

***Liatris aestivalis***, sp. nov., is recognized from Texas and Oklahoma as a species separate from *L. mucronata* DC. and *L. punctata* Hook., although it has been synonymized with both of the latter as *L. angustifolia* (Bush) Gaiser. The type of *L. angustifolia* is a plant best identified as *L. mucronata*, perhaps showing some influence of hybridization with *L. aestivalis*. *Liatris aestivalis* produces subglobose corms and has mostly been identified as *L. mucronata* but differs from it in foliar and capitular features as well as phenology. The new species is known from 16 counties primarily along a north-south band from central counties of Texas into south-central Oklahoma; it is sympatric with *L. mucronata* and the two sometimes grow in close association, but they are completely separated to barely overlapping in flowering period. Putative intermediates are identified from several counties in the region of their distributional overlap. ***Liatris glandulosa***, sp. nov., has been collected from five localities in Dallas County but is known to be extant at only a single site there; it also has been collected in three other Texas counties southward. It is similar to *L. aestivalis* in its subglobose corms and narrowly triangular, weakly graduate phyllaries but differs from all species of the genus in its vestiture of stipitate-glandular hairs. *Liatris glandulosa* also is early-flowering, nearly completely separated in phenology from *L. mucronata*, which grows in close sympatry at the Dallas County site. A description, illustration, distribution map, and key contrast with *L. mucronata* are provided here for each of the new species.

RESUMEN

***Liatris aestivalis***, sp. nov., se reconoce de Texas y Oklahoma como una especie separada de *L. mucronata* DC. y *L. punctata* Hook., aunque ha sido sinonimizada con estas dos últimas como *L. angustifolia* (Bush) Gaiser. El tipo de *L. angustifolia* es una planta que debe identificarse como *L. mucronata*, quizás muestre algo de influencia de hibridación con *L. aestivalis*. *Liatris aestivalis* produce bulbos subglobosos y ha sido identificada la mayoría de las veces como *L. mucronata* pero difiere de ella por las características foliares y del capítulo así como en la fenología. La nueva especie se conoce de 16 condados situados a lo largo de una banda norte-sur desde los condados centrales de Texas hasta el sur-centro de Oklahoma; es simpátrica con *L. mucronata* y ambas viven a menudo en íntima asociación, pero están completamente separadas o sólo ligeramente solapadas en el periodo de floración. Se han identificado intermedios putativos en varios condados de la región donde su distribución se solapa. ***Liatris glandulosa***, sp. nov., ha sido colectada de cinco localidades en el condado de Dallas pero se sabe que sólo permanece allí en una única localidad; también ha sido colectada en otros tres condados de Texas hacia el sur. Es similar a *L. aestivalis* por sus bulbos subglobosos, filarios débilmente atenuados y estrechamente triangulares pero difiere de todas las especies del género por su indumento de pelos estipitado-glandulares. *Liatris glandulosa* también florece antes, casi completamente separada en su fenología de *L. mucronata*, que crece en fuerte simpatria en la localidad del condado de Dallas. Se ofrecen aquí una descripción, una ilustración, mapa de distribución, y una clave que contrasta *L. mucronata* con las nuevas especies.

Field evidence and review of herbarium collections have revealed the presence of two previously undescribed species of *Liatris*, both of which are geographically centered in north central Texas. For the first, field observations led to re-evaluation of species definitions in the field and herbarium. For the second, review of earlier herbarium collections led to recognition of a distinctive species and field confirmation that it is still extant.

Contemporary botanists in north central Texas have observed the occurrence of early-flowering plants similar to *Liatris mucronata* DC. but distinct from it. Gaiser (1946, 1950) recognized these ‘non-*mucronata*’ plants as *L. angustifolia* (Bush) Gaiser, but her morphological and geographic definition of the taxon was diffuse. In contrast, *L. angustifolia* was treated by Shinnars (1951), Menhusen (1963), and in the Flora of Texas (Correll & Johnston 1970) as a synonym of *L. mucronata* and in a survey of the Oklahoma flora (Waterfall 1969) as a synonym of *L. punctata* var. *nebraskensis* Gaiser. The name *L. angustifolia* has been sporadically applied by original identification and annotation to a few of the collections cited in the present manuscript, but the name never gained currency as representative of a valid species. In other recent floras and checklists of Texas and Oklahoma (Hatch et al. 1990; Johnston 1990; Taylor & Taylor 1994; Jones et al. 1997; Diggs et al. 1999), these plants are identified as *L. mucronata* and *L. angustifolia* has not been included even as a synonym. Kartesz (1999) treated *L. angustifolia* as a synonym of *L. densispicata* (Bush) Gaiser ‘var. *interrupta* Gaiser’ (the correct disposition of ‘var. *interrupta*’ is as *L. mucronata* var. *interrupta* Gaiser).

With the benefit of field observations of phenologically distinct entities around Fort Worth and other north central Texas localities, we sorted collections of *Liatris mucronata* sensu lato from BAYLU, SMU/BRIT, TEX/LL, MO, OKL, and OKLA—arriving at a reasonable definition of two morphological groups, with a third group of possible intermediates. We examined types of taxa that held the possibility of representing the generally unrecognized (or diffusely recognized) entity from north central Texas and found that a name has not been correctly applied to it. In this report we provide a name for the species as well as means of identification and documentation of its geographical extent.

***Liatris aestivalis*** Nesom & O’Kennon, sp. nov. (Figs. 1, 2, 6). TYPE: U.S.A. TEXAS.

TARRANT CO.: W side of city of Fort Worth, undeveloped area (advertised for sale) with rock outcrops near corner of Green Oaks Drive and Genoa Road, NE corner of Ridgmar Mall area, shallow soil over Glen Rose (Cretaceous) limestone; major associates *Yucca pallida*, *Silphium albiflorum*, *Hedyotis nigricans*, *Ceanothus herbaceus*, *Sorghastrum nutans*, *Schizachyrium scoparium*, *Polygala alba*, *Salvia texana*, *Stenosiphon linifolius*, *Grindelia lanceolata* var. *texana*, *Phyllanthus polygonoides*, *Paronychia virginica*, *Oenothera macrocarpa*, *Vernonia lindheimeri*, *Scutellaria wrightii*, *Dalea hallii*, with *Liatris mucronata* common but generally in deeper soil, still in early bud; *Liatris aestivalis* abundant on flats and exposed slopes with little competition, plants in early to mid-flower, 8 Jul 2001, Guy L. Nesom FW15, Robert J. O’Kennon, and George M. Diggs (HOLOTYPE: BRIT; ISOTYPES: BAYLU, COLO, F, FLAS, GA, GH,

ISC, KANU, KSC, MIN, MO, NCU, NLU, NY, OKL, RM, SBSC, TAES, TENN, TEX, UARK, UC, UNM, US—to be distributed).

Differt a *L. mucronata* DC. foliis inferis longioribus, phyllariis angustioribus paucioribus leniter 2–3-seriatis, et florescentia praecici.

*Plants* 20–65 cm tall (avg. ca. 30 cm), with 1–2(–5) erect stems arising from a globose or subglobose corm 13–30 mm in diameter; stems, leaves, and phyllaries densely punctate with imbedded, clear-resinous glands, otherwise mostly glabrous. *Leaves* crowded, spreading-ascending, 0.6–2.5 mm wide, the lower 7–15 cm long, shortened upward, usually ca. 1/3 as long at midstem and half as wide, usually reduced to short, spreading bracts in the lowermost part of the capitulescence, margins smooth to minutely papillate or sparsely short-ciliate, the narrower not punctate, the broader inconspicuously punctate, otherwise glabrous. *Capitulescence* 4–15 cm long, ca. 13–30 mm wide, capitula densely arranged, upper cauline leaves sometimes continuing upward as capitular bracts not wider than the capitulescence. *Capitula* turbinate-cylindric, 9–12 long, 3.5–5 wide; phyllaries 6–11 per head, in 2–3 series weakly graduate in length, the outermost ca. 1/2–2/3 the length of the inner, inner 11–12 mm long, oblong-lanceolate to lanceolate-triangular, acute to acute-attenuate at the apex, not abruptly mucronate or cuspidate but sometimes with a long, narrow tip, commonly becoming dark purple in anthesis, glabrous or the outer sparsely ciliate. *Florets* 3–4(–5) per head; corollas pink-purple, sessile-glandular, 6–10 mm long, tube 4–7 mm long, glabrate within, lobes lanceolate, 1.5–3 mm long; filaments sparsely puberulent-pilose. *Cypselae* 4.5–6 mm long, oblong-oblan-ceolate in outline, compressed to distinctly 3-angled, with 9–11 longitudinal nerves, densely hairy on nerves and interstices with duplex hairs (0.2–)0.4–0.6 mm long, sometimes minutely sessile-glandular; pappus of plumose bristles 5.5–8 mm long, ca. equal the corolla length. Chromosome number unknown.

*Etymology*.—The epithet alludes to the summer flowering of the species, a distinctive feature compared to *L. mucronata*.

Additional collections examined: U.S.A. **OKLAHOMA**. **Atoka Co.**: 3.0 mi N of Caddo, rocky hillside, 11 Jul 1967, *Johnson 172* (OKL). **Bryan Co.**: 2 mi W, 1.5 mi N of Matoy, pine-oak woods, 23 Jul 1962, *C. & J. Taylor 916* (OKL). **Johnston Co.**: 2.5 mi W and 1 mi N of Mannsville, on Baum Limestone outcrop, Jun 1960, *Taylor s.n.* (OKL). **Love Co.**: 6.5 mi NE of jct OK 77 on OK 32 (ca. 8 mi E of Marietta), limestone outcrop, eroded sandy slope, post oak-juniper woods, 270 m elev., 14 Aug 1979, *Wagner and Solomon 4070* (MO-2 sheets). **Marshall Co.**: 1 mi SE of Madill, prairie, 21 Jul 1959, *Goodman 6921* (OKL, SMU). **Murray Co.**: open prairie near Sulphur, 5 Aug 1939, *Broadbent 598* (OKL); Platt National Park, Cold Spring, near Sulphur, 20 Jun 1935 [early flower], *Merrill 703* (MO); Platt National Park, Flower Park, near Sulphur, 30 Sep 1935 [past flower], *Merrill 1535* (MO). **TEXAS**. **Anderson Co.**: ca. 350 m S of jct Co. Road 425 on Co. Road 2202, N 31.73987, W 95.73025, limestone outcrop, 2 Jun 1999, *Holmes 10140* (BAYLU)—*L. mucronata* collected at the same site on 25 Oct 1997, *Singhurst 6132a* (BAYLU). **Cooke Co.**: near Tyler Bluff, W edge of county, blackland prairies, 2 Jul 1946, *Correll and Correll 12961* (SMU); NE side of St. Jo, Co. Road 414—Brushy Mound Road, W of FM 2382, calcareous soil, 7 Aug 1995, *Lusk s.n.* (BRIT); Don Vogel Ranch (Elm Fork of the Trinity River), Co. Road 302, 2 mi E of Montague Co. line, 13 Aug 1995, *Lusk s.n.* (BRIT); **Cooke Co.**: County Road 343 0.5 mi S of FM 1630, Freemound

Community, growing in close proximity to *L. mucronata* (also see 22 Jul collection of putative intermediate *L. mucronata* × *L. aestivalis* made from nearby locality), 14 Jul 2001, *Lusk s.n.* (BRIT); 3 mi S of Era on FM 51, ranch of J. David Thomas, M.D., 16 Jul 2001, *Lusk s.n.* (BRIT); Marysville Community, 1.1 mi S of Co. Road 408 on E side of Co. Road 417 (0.7 mi S of N. Fish Creek bridge), 2 Aug 2001, *Lusk s.n.* (BRIT). **Coryell Co.:** 5 mi W of Gatesville, prairie, 23 Aug 1945, *Muller 8732* (LL, MIN, SMU). **Denton Co.:** 15.5 mi W of Denton, gravelly (limestone) shoulder above stream, 9 Oct 1949 [end of fruiting], *Shinners 11892* (SMU); between Sanger and Denton on I-35, along service road, 0.7 mi N of FM 3163 (Milam Road), *L. mucronata* growing nearby, (locality found by Jeff Quayle), 17 Jul 2001, *Lusk s.n.* (BRIT). **Hays Co.:** 2 mi SE of Wimberly, across road from entrance to Hidden Valley Ranch, common locally on shallow limestone slopes, 30 Aug 1948 [very end of flowering], *Johnson 383* (TEX). **Montague Co.:** Hugh Garnett Ranch, ca. 4 mi SW of Dye Mound on FM 3206, 7 Aug 1995, *Lusk s.n.* (BRIT); Don Vogel's Hardy Ranch, FM 1630 at FM 677, in Hardy community, SE corner of the county, *L. squarrosa* growing nearby, 14 Jul 2001, *Lusk s.n.* (BRIT); Don Vogel's Littlefield Ranch, Littlefield Road at Gladys Community, E of FM 677, growing with *L. squarrosa*, 14 Jul 2001, *Lusk s.n.* (BRIT); Jane D. Lucas Ranch, FM Road 677, 5 mi S of jct with US Hwy 82 in center of Saint Jo, 14 Jul 2001, *Lusk s.n.* (BRIT); Garnett property, ca. 4 mi S of Dye Mound on Dye Mound Road, ca. 8 air mi SW of Saint Jo, sandy soil over limestone, *L. aestivalis* in early flower and common on rocky slopes, *L. mucronata* abundant but none yet in flower, 10 Jul 2001, *Nesom FW16* with Garnett, Lusk, Miller, O'Kennon, and Quayle (BRIT, TEX); Nored Road, between Farm Road 455 and Dye Mound Road, ca. 11 air mi SSW of Saint Jo, hillside along road, exposed limestone and shallow sandy soil, *L. aestivalis* abundant, in early flower, 10 Jul 2001, *Nesom FW39* with Garnett, Lusk, Miller, O'Kennon, and Quayle (BRIT); site of old Dye Community, Farm Road 3206 at jct with Dye Mound Road, ca. 7 mi SW of Saint Jo on FR 3206; steep, eroding limestone slopes, *L. aestivalis* in early flower and abundant on open slopes, *L. mucronata* common, not yet in flower, 10 Jul 2001, *Nesom FW44* with Garnett, Lusk, Miller, O'Kennon, and Quayle (BRIT, TEX); Clear Creek Loop (road), between Farm Road 3206 and 677, ca. 0.6 mi SSE of jct with Farm Road 3206, ca. 5 air mi S of Saint Jo, open roadside with exposed limestone outcrop and shallow soil, nearly clay-sand, steep slopes by side, *L. aestivalis* relatively common, barely into flower, 10 Jul 2001, *Nesom FW46* with Garnett, Lusk, Miller, O'Kennon, and Quayle (BRIT, KSC); Clear Creek Loop (road), between Farm Road 3206 and 677, ca. 1 mi SW of jct with Farm Road 677, ca. 2.5 air mi S of Saint Jo, open roadside with exposed limestone outcrop and shallow soil, *L. aestivalis* relatively common, barely into flower, 10 Jul 2001, *Nesom FW47* with Garnett, Lusk, Miller, O'Kennon, and Quayle (BRIT, TEX). **Parker Co.:** Ranch House Road 200 meters north of Vista Road near Lake Weatherford, deep sand, *L. mucronata* also in immediate area but not in flower, 6 Aug 2001, *O'Kennon 15007* and Jeff Quayle (BRIT, TEX). **Tarrant Co.:** [no other locality data], 1 Aug 1926, *Killian 6577* (LL); WSW part of city of Fort Worth, between Cumberland St. and Vickery Blvd, just N of Vickery, E of Ridglea Hills Elementary School, publicly owned land (Ridglea Hills Park), open area of limestone slopes, with scattered small trees, *L. mucronata* on upper slopes and not yet in flower, 12 Jul 2001, *Nesom FW48* and O'Kennon (BRIT, TEX); SW part of city of Fort Worth, N side of Winscott/Vickery Blvd., 0.7 mi NE of jct with Hwy 377, just N of jct Hwy 377 and IH 20, open relatively flat limestone outcrop on N side of road, alongside road at edge of public land (Z. Boaz South Park), 12 Jul 2001, *Nesom FW51* and O'Kennon (BRIT, KSC); SW part of city of Fort Worth, Lakeview Road just W of Benbrook Lake, 0.3-0.4 mi E of jct with Hwy 377, open limestone outcrop, gentle slope, this habitat relatively continuous for ca. 0.3 mi eastward along Lakeview Road, *L. mucronata* abundant, long before flowering, 12 Jul 2001, *Nesom FW53* and O'Kennon (BRIT); W portion of City of Fort Worth, Westridge Drive ca. 2 blocks N of jct with Vickery Blvd., undeveloped lot with open, steep slopes of Glen Rose limestone outcrop and shallow silty soil, 22 Jul 2001, *Nesom FW55* (BAYLU, BRIT, KSC, TEX); Tandy Hills Municipal Park, ca. 2 air mi E of downtown Fort Worth, N of Hwy 30, limestone slopes with shallow to deeper soil on flats and slope bottoms, *L. mucronata* abundant on lower slopes in deeper soil but not yet in flower, 22 Jul 2001, *Nesom FW56* and O'Kennon (BRIT, KSC, OKL, TEX, US); Ft. Worth, 26 Jul 1929, *Whitehouse s.n.* (TEX). **Travis Co.:** rocky hillsides and summits

around Austin, 1 Aug 1926, *Tharp s.n.* (SMU). **Wise Co.:** dry gravelly prairies on steep sandstone slopes, on E side of co. road E of Big Sandy Creek, ca. 4 air mi NE of Alvord and ca. 3.8 air mi ESE of Park Springs, Post Oak Ridge, LBJ Natl. Grassland, 850–930 ft, Antlers Sand Formation, 1 Aug 1989, *Orzell and Bridges 11265* (TEX); just N and W of Bald Knob Cemetery, ca. 1 air mi S of LBJ Natl. Grassland field headquarters, ca. 3.3 air mi ENE of Alvord and 10 air mi NNW of Decatur, Bald Knob Hill, LBJ Natl. Grassland, shallow soil limestone prairies/outcrops, 1100–1180 ft, 1 Aug 1989, *Orzell and Bridges 11287* (BRIT, TEX).

Gaiser (1946, p. 370) noted that “confusing intermediates” apparently are formed between *Liatris angustifolia* and *L. mucronata*, especially as “the centre of the range for both of these species lies in central Texas.” A group of plants putatively intermediate between *L. aestivalis* and *L. mucronata* is recognized here: most of these plants have foliar features similar to *L. mucronata* and a large number of phyllaries ((11–)13–18) strongly graduate in length, like those of *L. mucronata*; the flowering period of these populations ranges from July through mid-October (the flowering dates of these collections are not included in Table 1). In contrast, these plants have relatively long phyllaries, at the upper range for *L. mucronata*, the inner with longer, more attenuate apices than typical for *L. mucronata*, more similar to those of *L. aestivalis*. The geographic coherence of the putative ‘intermediates’ (as cited below) suggests that they may have a similar evolutionary origin. As a tentative identification, these collections have been annotated as “*L. mucronata* possibly > *L. aestivalis*,” although their distribution ranges somewhat outside of the known range of *L. aestivalis* (compare Figs. 5 and 6). The type of *L. angustifolia* (provenance uncertain, see comments below) is similar to plants of this group.

*Nesom FW57* (intermediate, from Tandy Hills in Fort Worth) was flowering at the same time as typical *Liatris aestivalis* (*Nesom FW56*) at the same site but considerably before *L. mucronata* (*Nesom FW58*). At this locality, *L. mucronata* and the putative intermediate (easily distinguished in the field) grew in relatively deeper soil and were both more abundant than the typical *L. aestivalis*, which occurred only on a relatively small area of limestone outcrop. Only three major phenotypes were evident among the Tandy Hill plants—those putatively intermediate were obvious but evidence of introgression was not. *Lusk s.n.* (Cooke Co., Tex.) also was flowering at the same time as *L. aestivalis* at the same site (*Lusk s.n.*, above) but well before *L. mucronata* (not collected).

POSSIBLE INTERMEDIATES BETWEEN *L. AESTIVALIS* and *L. MUCRONATA*: **OKLAHOMA. Love Co.:** 8 mi E of Marietta, roadside cut W of Hickory Creek, 1 Aug 1958, *Goodman 6713* (OKL). **TEXAS. Bosque Co.:** Hwy 174, 3.6 mi SW of Walnut Springs, 25 Sep 1950, *Cory 58025* (SMU); **Clay Co.:** 5.2 mi E of Henrietta, Hwy 82, 6 Oct 1945, *Whitehouse 10848* (SMU). **Cooke Co.:** Cla Hamilton Freemound Ranch, 1.8 mi S of FM 1630, 0.8 mi E of gate on County Road 343, these plants apparently intermediate between *L. mucronata* (typical plants nearby) and *L. aestivalis*, 22 Jul 2001, *Lusk s.n.* (BRIT); J. & M. Tepera Ranch, Co. Rd. 414, 0.1 mi W of Brushy Mound Cemetery on S side, NE of Saint Jo, 28 Jul 2001, *Lusk s.n.* (BRIT). **Dallas Co.:** S side of Tenison Park, 9 Sep 1950, *Cory 57909* (SMU); Dallas, 10 Jul 1925, *Hynes s.n.* (TEX); off Northwest Highway, E of Vickery, 7 Sep 1940, *Longnecker 79* (SMU). **Fannin Co.:** ca. 3 mi SE of Bonham, among grasses in open, scrub oak-cedar hills of Bonham State Park, 16 Sep

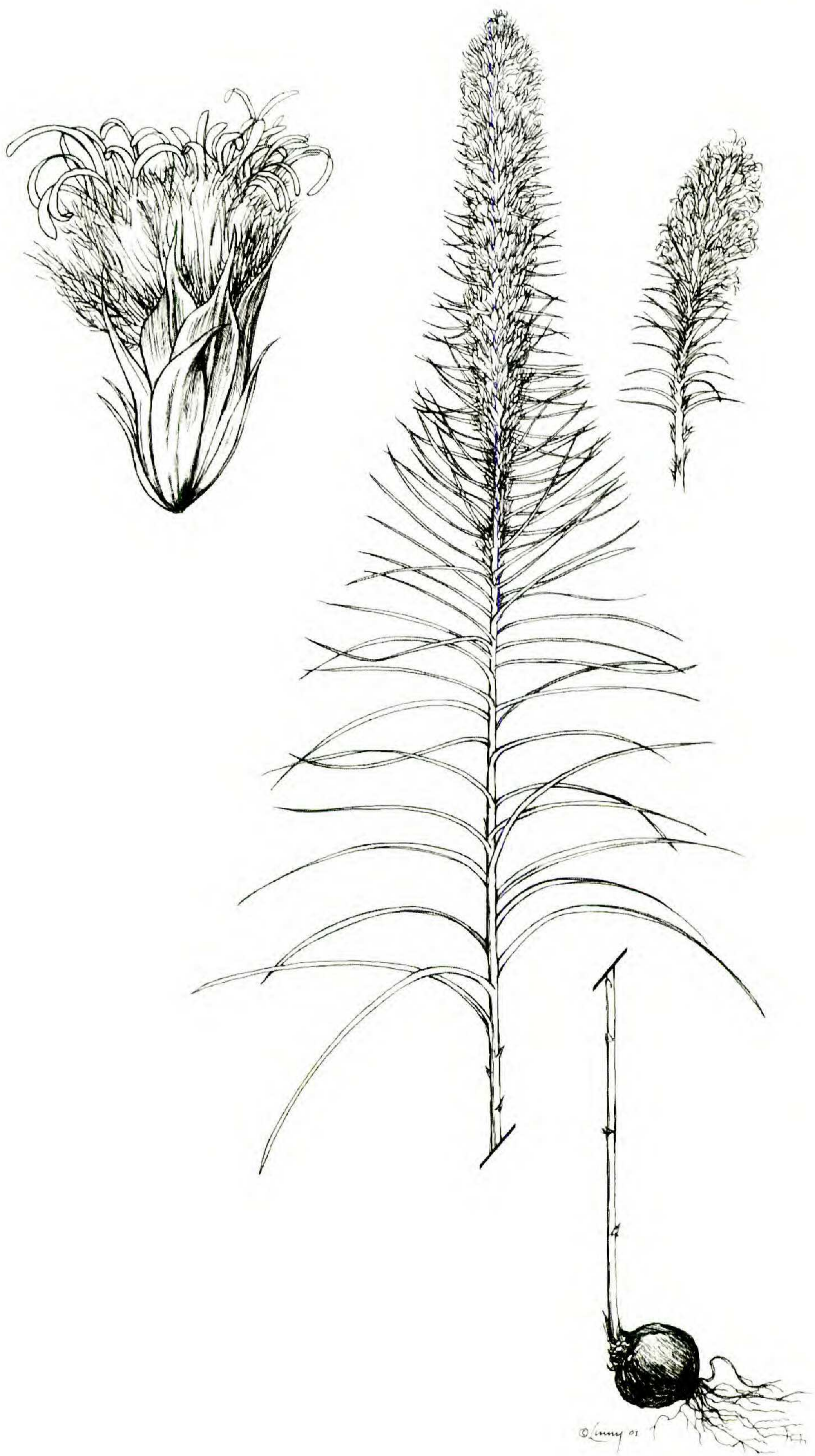


FIG. 1. Habit and details of *Liatris aestivalis* (from the type collection).



FIG. 2. Habit and details of *Liatris aestivalis*.

1960, *Correll* 23498 (LL). **Grayson Co.:** 6 mi SE of center of Sherman, remnant prairie vegetation, Chamberlain's Ridge substation, 23 Sep 1993, *Nee* 43947 (MO). **Hood Co.:** Hwy 171, 2.8 mi NW of Cresson, 30 Sep 1950, *Cory* 58481 (SMU). **Montague Co.:** 10 mi E of St. Joe, 3 Oct 1975, *Lipscomb* 554 (SMU). **Navarro Co.:** 15.7 mi SE of Corsicana on Hwy 75, 2 Oct 1949, *Shinners* 11809 (SMU). **Tarrant Co.:** 3 mi W of Ft. Worth, 23 Sep 1936, *McCart* s.n. (SMU); Tandy Hills Municipal Park, ca. 2 air mi E of downtown Fort Worth, N side of Hwy 30, limestone slopes with shallow to deeper soil on flats and slope bottoms, 22 Jul 2001, *Nesom* FW57 with O'Kennon (BRIT, KSC, OKL, TEX, US); dry, stony ground, 2 Sep 1929, *Ruth* 78 (SMU); SE of Fort Worth near Village Creek, 4 Oct 1946, *Whitehouse* 17295 (SMU).

### Taxa of Series *Punctatae*

The taxa involved in the present study are members of sect. *Liatris* series *Punctatae* Gaiser (1946), which is characterized by relatively few-flowered capitula, phyllaries with non-petaloid tips, and a plumose pappus. Of the five species recognized by Gaiser in series *Punctatae*, *L. punctata* Hook. and *L. densispicata* (Bush) Gaiser are distinct in their elongate rootstock-like corms (vs. globose to subglobose corms). *Liatris densispicata* was regarded by Gaiser as endemic to Minnesota; it has more recently been treated as a synonym of *L. punctata* (Ownbey & Morley 1991). *Liatris bracteata* Gaiser is a Texas endemic distinct in its large, many-flowered (10–14 florets) capitula on relatively long peduncles. *Liatris mucronata*, *L. aestivalis*, and the second new species (described below) are similar in their relatively few-flowered capitula and globose to subglobose corms.

Infraspecific variants have been described in both *Liatris mucronata* and *L. punctata*, but in most of Texas and Oklahoma *L. mucronata* is closely similar to *L. punctata*, except for the difference in corm morphology. They intergrade in parts of their range, as noted by Gaiser (1946) and Menhusen (1963). Fig. 5 (present manuscript) maps *L. mucronata* as well as *L. punctata* and indicates that they have a nearly contiguous range in Texas. Plants with intermediate morphology are relatively common along the zone where their ranges meet. In Texas, the morphological difference between *L. aestivalis* and *L. mucronata* is easier to ascertain than that of *L. punctata* and *L. mucronata*, since the critical features of distinction are not underground parts. Within series *Punctatae*, we focus on comparisons of *L. aestivalis* with *L. mucronata* because of their similarity in corm morphology and their recent conceptual confusion.

### Distinction of *Liatris aestivalis*

The original circumscription of *Liatris* (*Lacinaria*) *angustifolia* by Bush is not adequate to distinguish it from *L. mucronata* and the specimens of *L. angustifolia* cited by him include collections of *L. mucronata*. In Gaiser's morphological description of *L. angustifolia*, she fairly clearly was observing the core of the same taxon recognized here as *L. aestivalis*, but she also cited various out-of-range Texas collections (here regarded as *L. mucronata*), apparently including plants with atypically long but otherwise *mucronata*-type phyllaries.

Also among Gaiser's citations for *Liatris angustifolia* are collections from



southern Missouri, eastern Kansas, and Nebraska. Our examination of collections from these states, as well as northern Arkansas, confirms their similarity to *L. aestivalis*, but this 'northern segment' is distinct in a number of features (mostly 'gigas' compared to *L. aestivalis*) and geographically disjunct. While evidence for the distinction of *L. mucronata* and *L. aestivalis* in Texas and Oklahoma is clear, variation patterns in the overall range of both *L. mucronata* and *L. punctata* need to be restudied.

Morphological differences between *Liatris aestivalis* and *L. mucronata* are conspicuous in features of the capitula. The long lower cauline leaves, abruptly reduced upward, also provide a useful feature of differentiation. Plants of *L. aestivalis* also are generally shorter, thinner-stemmed, and have smaller corms producing a smaller number of stems, but these differences are hard to quantify on the basis of herbarium specimens, as collectors avoid the larger difficult-to-press plants.

The flowering period of *L. aestivalis* is earlier than that of *L. mucronata* (Table 1). At most localities, the two apparently are complete separate in flowering period—if overlap occurs, it is only for a short time around the end of August. In fact, the flowering period of a given population appears to be a fairly reliable indicator of its identity (*L. aestivalis* vs. *L. mucronata*). As identified here, *L. aestivalis* also has a relatively discrete geographic distribution (Fig. 6), although it is imbedded within that of *L. mucronata*. Details of morphological and phenological differences between the two taxa are given in the following couplet.

1. Lower cauline leaves usually 2–3.5 times longer than the midcauline and 1.5–2 times wider; phyllaries 6–11 per head, in 2–3 series weakly graduate in length, the outermost ca. 1/2–2/3 the length of the inner, inner 11–12 mm long, oblong-lanceolate to lanceolate-triangular, acute to acute-attenuate at the apex, not mucronate or cuspidate but sometimes with a long, narrow tip, lateral veins usually evident above the middle and continuing to nearly the apex; florets 3–4(–5) per head; flowering mostly mid-July through mid-August \_\_\_\_\_ **Liatris aestivalis**
1. Lower cauline leaves similar to the midcauline in length and width; phyllaries 11–15(–18) per head, in (4–)5–6 series strongly graduate in length, the outermost 1/3–1/5 the length of the inner, inner 7–9 mm long (–12 mm in putative intermediates), mostly oblong-obovate and obtuse to abruptly truncate-rounded at the apex, tipped by a thick, often spinulose mucro or cusp, lateral veins usually not evident above the middle or at least on the distal third; florets (3–)4–5(–6) per head; flowering mostly mid-September through mid-October \_\_\_\_\_ **Liatris mucronata**

### Habitat and plant associates

Populations of *Liatris aestivalis* in Tarrant County apparently are restricted to sites with shallow soil over outcrops of Glen Rose Limestone, on slopes or on flatter areas at the slope bases. The exposed limestone at other *L. aestivalis* sites in Texas and Oklahoma is closely similar in origin and characteristics to the Glen Rose formation. The species apparently is true to such sites, except for the

Parker County plants (*O'Kennon 15007*), which grow in deep sand. The latter, however, are otherwise inseparable from typical *L. aestivalis*, which also grew in a typical habitat about 50 feet away. Corms of the new species tend to be shallow (1–5 cm below the surface, or even partly exposed) in relatively loose soil, but some occur in rockier substrate.

Associated plant species at these limestone outcrops in Tarrant County are remarkably predictable: *Artemisia ludoviciana* var. *mexicana*, *Ceanothus herbaceus*, *Chamaesyce fendleri*, *Dalea hallii*, *Dyssodiopsis tagetoides*, *Echinacea angustifolia*, *Eryngium leavenworthii*, *Grindelia lanceolata* var. *texana*, *Hedyotis nigricans*, *Heliotropium tenellum*, *Marshallia caespitosa*, *Opuntia humifusa*, *Paronychia virginica*, *Penstemon cobaea*, *Phyllanthus polygonoides*, *Polygala alba*, *Salvia texana*, *Schizachyrium scoparium*, *Scutellaria wrightii*, *Silphium albiflorum*, *Sorghastrum nutans*, *Stenosiphon linifolius*, *Stylingia texana*, *Thelesperma filifolium*, *Vernonia lindheimeri*, and *Yucca pallida*. In Tarrant County, *Yucca pallida* is a conspicuous and reliable predictor of the presence of *L. aestivalis*, although the *Liatris* is even more simply located by looking for exposed slopes with the white limestone. In Montague County, *Yucca arkansana* replaces *Y. pallida* as a conspicuous associate of *L. aestivalis* and other local variations in species composition are evident.

*Liatris mucronata* also occurs at most sites where we have found *L. aestivalis*, providing evidence that the two taxa are distinct. While there is overlap in microhabitat, *L. mucronata* occurs in deeper soil, compared to the rocky, shallow soil to which *L. aestivalis* is restricted. Presumably, the combination of phenological separation and distinction in microhabitat provides genetic isolation between the two taxa. The broader ecological range of *Liatris mucronata* corresponds with a geographic range wider than that of *L. aestivalis* (compare Figs. 5 and 6).

Chromosome numbers for taxa of series *Punctatae* have been reported by Gaiser (1950) and Menhusen (1963). Counts for *L. mucronata* (two populations—Comal and Nueces cos., Tex.) were diploid ( $2n = 20$ ). Counts for “*L. angustifolia*” from eight localities were diploid; a single population of this taxon, from Wichita Co., Tex., was reported by Gaiser to have plants at diploid and tetraploid levels. It is not clear that sampling by Gaiser included plants identified here as *L. aestivalis*, and Menhusen did not include Texas plants in her study.

### **Types examined**

*Lacinaria angustifolia* Bush, Amer. Midl. Naturalist 12:315. 1931. *Liatris angustifolia* (Bush) Gaiser, Rhodora 48:368. 1946. TYPE: TEXAS. “Cultivated specimen in green house from seed from Texas plants, TYPE, type locality unknown, sheet No. 211347” (as cited by Bush 1931, p. 315); the specimens label has “Cult. Green House fr. Texas,” (HOLOTYPE: MIN!). Date of greenhouse collection not indicated.

Gaiser (1946, p. 369) gave the type locality of *Lacinaria angustifolia* with more precision—“Tarrant Co.: dry soil, Fort Worth, Sept. 5, 1912, A. Ruth 78 (M, 211347),”

but in this she apparently took label data from some other specimen giving the collection number as "Ruth 78," perhaps even confusing it with the type of *Lacinaria ruthii* (see below). Ruth, however, used the number "78" on labels of *Liatris* of various collections from different localities and different dates, although all of them apparently were made from Tarrant County or nearby localities. Bush received specimens from Albert Ruth for use in his study, but if Ruth collected the seeds from which the type of *L. angustifolia* was grown, it is curious that Bush was not able to provide more precise collection data.

This plant is similar to those cited above as perhaps indicating gene flow between *Liatris aestivalis* and *L. mucronata*. As in *L. mucronata*, it has leaves nearly equal in length and width from base to midstem, and the 15 phyllaries are strongly graduate in length, forming a distinctly cylindrical involucre, and with densely ciliate margins. The phyllaries, however, are more elongate than typical for *L. mucronata* and the apices vary from obtuse-mucronate to ovate-lanceolate. We have annotated this collection as "*Liatris mucronata* perhaps with genetic influence of *L. aestivalis*."

*Lacinaria leptostachya* Bush, Amer. Midl. Naturalist 12:314. 1931. TYPE: TEXAS. TARRANT CO.: on poor, rocky, sterile ground, 10 Jun 1923, A. Ruth 24 (HOLOTYPE: ISC!).

This was treated by Gaiser (1946) as a synonym of *Liatris mucronata*, and that identity is confirmed here. The collection is a single plant with six flowering stems from a globose corm. The capitulescence is narrow (hence the epithet) and the capitula have mostly three florets each, but the capitula have ca. 15 phyllaries and the shape and apex are similar to those of *L. mucronata*. Phyllaries are conspicuously tomentose on the lamina and have finely long-ciliate margins. The collection date is anomalous and probably is incorrect—the spikes are in full flower or slightly past (no unopened florets remaining)—a flowering date anytime in June is considerably earlier than any known collection of *L. mucronata* and most collections of *L. aestivalis* (see Table 1).

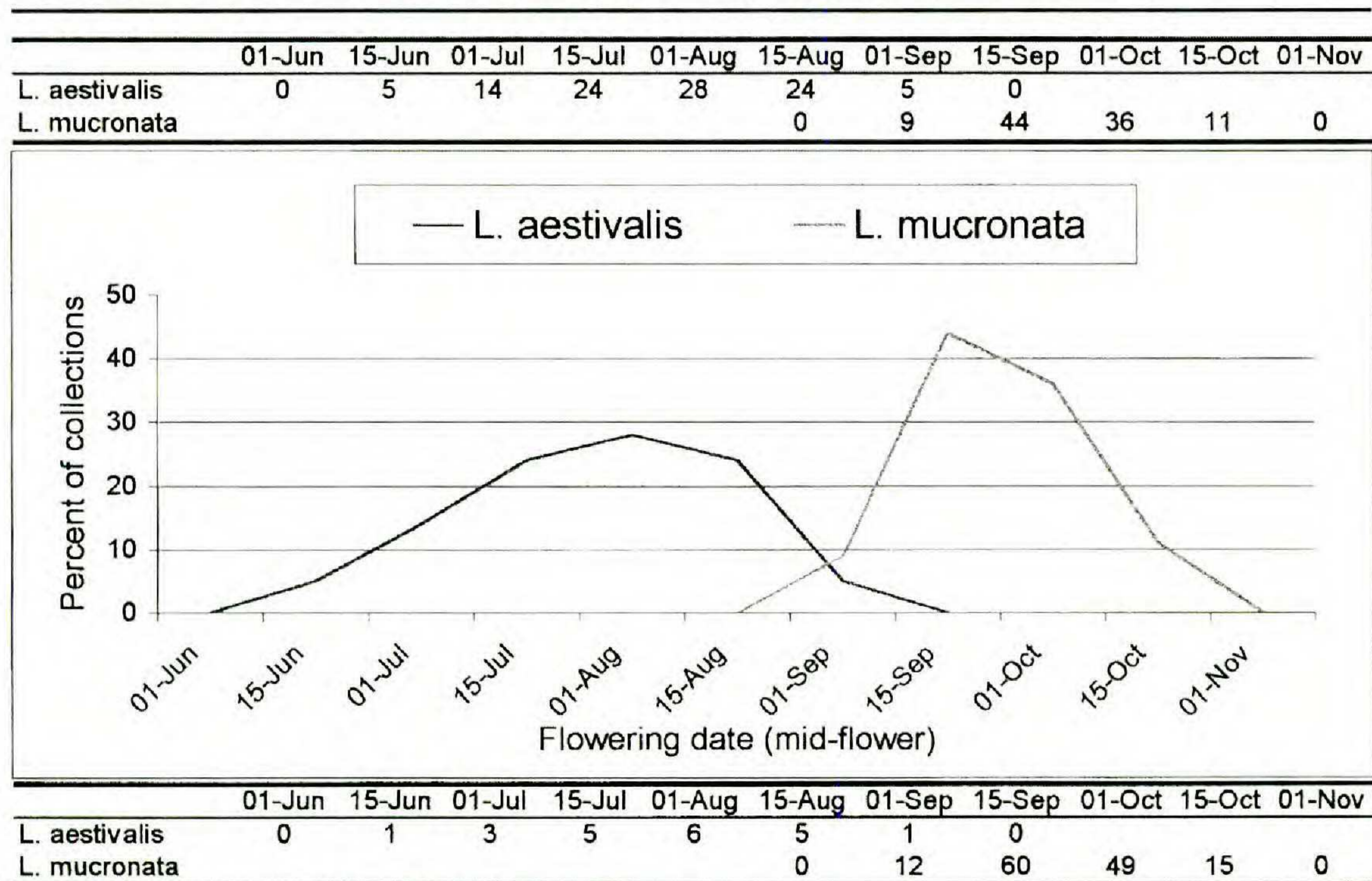
*Lacinaria ruthii* Bush, Amer. Midl. Naturalist 12:316. 1931 (non *Lacinaria ruthii* Alexander 1933 = *Liatris squarrulosa* Michx.). TYPE: TEXAS. TARRANT CO.: Polytechnic, 5 Sep 1912, A. Ruth 78 (HOLOTYPE: MIN!).

This was regarded by Gaiser (1946, p. 370) to be among intermediates between *L. angustifolia* and *L. mucronata*, but the type specimen belongs with nearly typical *L. mucronata*. Flowering in early September is early for *L. mucronata*, late for *L. aestivalis*, but all morphological features of this plant are *L. mucronata*: phyllaries 18 in number, strongly graduate in length, with an abruptly rounded, cuspidate apex, lightly tomentose on the surface, with ciliate margins; florets 4 per head.

#### A STIPITATE-GLANDULAR SPECIES OF *LIATRIS*

In examination of collections identified as *Liatris mucronata*, a small set of plants with stipitate-glandular vestiture was separated. These collections were

TABLE 1. Flowering phenology of plants of *Liatris aestivalis* and *L. mucronata* in Texas and southern Oklahoma. Lower tabular data show number of collections scored at mid-flower for each date (*L. aestivalis*: 21 total collections; *L. mucronata*: 136 total collections; for each collection scored, an estimate was made of when the plant/plants was/were in mid-flower). Upper tabular data show percentage of the total number of collections scored at mid-flower. Graph show species compared by the percentage of the total number of collections scored at mid-flower. At most sites where the two species co-occur, overlap in flowering apparently occurs rarely or not at all.



made in the 1930s and early 1940s from within Dallas County, before dense residential, commercial, and transportation development covered most of the natural habitat. A collection of this entity was made in 1936 by L.O. Gaiser, who also obtained chromosome counts from five plants of the population, and the SMU sheets were examined by Cory and Shinnors, but none of these researchers apparently found taxonomic significance in the distinctive features of these plants. In the present perspective, however, the vestiture of these plants is unique in the genus, and other features set it apart from *L. mucronata*. The discovery of a large, multi-segmented population in a nature preserve, growing sympatrically with *L. mucronata* but obviously distinct from it in morphology and phenology, allows us unhesitatingly to describe it at specific rank.

***Liatris glandulosa*** Nesom & O'Kennon, sp. nov. (Figs. 3, 4, 6). TYPE: U.S.A. TEXAS. Dallas Co.: City of Garland, Dallas metro area, ca. 16 air mi NW of downtown Dallas, Spring Creek Forest Preserve, between Interstate Hwy 190 and Arapaho Road, vicinity of Holford Road, natural habitats on open relatively flat, limestone outcrops (Austin Chalk formation) and also on quarry fill, 21 Jul 2001, Guy L. Nesom FW62 with Robert J. O'Kennon and Thomas M. Frey (HOLOTYPE: BRIT; ISOTYPES: GH, KSC, MO, NY, OKL, TEX, US—to be distributed).

Differt a *L. mucronata* DC. vestimento stipitato-glanduloso, foliis latioribus laxioribus, phyllariis paucioribus leniter 3-4-seriatis, et florescentia praecoci.

*Plants* 3–6 cm tall with 1–2(–4) erect stems arising from a subglobose to depressed-globose corm 2–4 cm in diameter; stems, leaves, and phyllaries densely punctate with imbedded, clear-resinous glands, stems and leaves also densely stipitate-glandular with trichomes 0.1–0.2(–0.3) mm high, the whole plant sticky to the touch, very sparsely arachnoid, especially along the margins. *Leaves* crowded, spreading-ascending or the lower slightly deflexed, rigid to lax, the lower 6–11 cm long, 1.5–4(–4.5) mm wide, usually 1/2–1/3 as long at midstem and ca. 1/2 as wide, usually reduced to short, spreading bracts in the lower part of the capitulescence. *Capitulescence* 8–18(–28) cm long, mostly 1.5–2.5 cm wide, of densely arranged capitula. *Capitula* turbinate-cylindric, 8–12 mm long, 3–5 mm wide; phyllaries 7–10(–12) per head, in 3–4 series weakly graduate in length, the outermost 1/2–2/3 the length of the inner, inner 9–11(–12) mm long, oblong-lanceolate to lanceolate-triangular, broadly to narrowly acute or acuminate at the apex, sometimes with an indurate mucro, green, rarely becoming purplish, very densely glandular with a mixture of sessile-sunken glands and slightly elevated ones, margins narrowly hyaline below the apex. *Florets* 3–4(–5) per head; corollas pink-purple, punctate-glandular, 7–8 mm long, tube 4–5 mm long, glabrous to glabrate within, lobes linear-lanceolate, ca. 3 mm long; filaments puberulent-pilose. *Cypselae* 5–6 mm long, oblong-oblongate in outline, brown to nearly black, compressed to 3-angled, with 8–10 nerves, densely hairy on nerves and interstices with duplex hairs 0.2–0.6 mm long; pappus of plumose bristles 6–7.5 mm long, ca. equal the corolla length. Chromosome number,  $2n = 20$  (Gaiser 1950).

*Etymology.*—The epithet alludes to the stipitate-glandular vestiture of the species, a distinctive feature compared to *L. mucronata* and all other species of the genus.

Additional collections examined: **TEXAS. Bosque Co.:** ca. 4 mi S of Clifton along Hwy 6, 1 Sep 1946, Pudig and York 46334 (LL, MO); gravel road E of Tx Hwy 6 and ca. 2.5 NW of Clifton, N of Meridian Creek, dry, gravelly limestone hill, 800 ft, Comanche Peak limestone, community dominated by *Juniperus ashei*-*Quercus buckleyi*, 6 Aug 1989, Orzell and Bridges 11401 (TEX). **Dallas Co.:** 11 mi W of Dallas on US Hwy 80, chalky limestone (Austin Chalk) at fault on road to Ft. Worth, voucher for chromosome count of  $n = 10$ , 27 Aug 1936, Gaiser 122 (OKL); N of University Park, prairie, 2 Aug 1940, Longnecker 6 (LL, SMU-2 sheets); [city of Dallas], off Hillcrest Road [in current vicinity of Southern Methodist University], on limestone outcrop, 21 Aug 1942, Lundell 11561 (LL, SMU); Duncanville, Dallas metro area SW of downtown Dallas, junction of Clark Road and Camp Wisdom Road, ca. 2 acre lot on NE corner, currently advertised for sale, shallow, gravelly limestone soil, common species *Carduus nutans*, *Cirsium undulatum*, *Centaurea solstitialis*, *Mentzelia oligosperma*, *Diplotaxis muralis*, *Solidago altissima*, *Hedyotis nigricans*, ca. 10 plants of *Liatris glandulosa* in mid flower, 25 Jul 2001, Nesom FW75 and O'Kennon (BAYLU, BRIT, COLO, GH, ISC, KSC, MIN, MO, NCU, NLU, NY, OKL, RM, TEX, TAES, UC, US); Coomb's Branch, 19 Aug [without year], Reverchon s.n. (MO). **McLennan Co.:** W of Hillcrest Hospital, limestone soil on creek bank, 9 Aug 1947, Smith 1007 (TEX). **Travis Co.:** "pocket" in rocks on Bee Creek, 6 Sep 1901 [past flr, frting heads shattering], Ferguson 451 (TEX).

We found plants of *Liatris glandulosa* in two Dallas County sites where collections had not been previously made. The Duncanville site is about 6 miles south

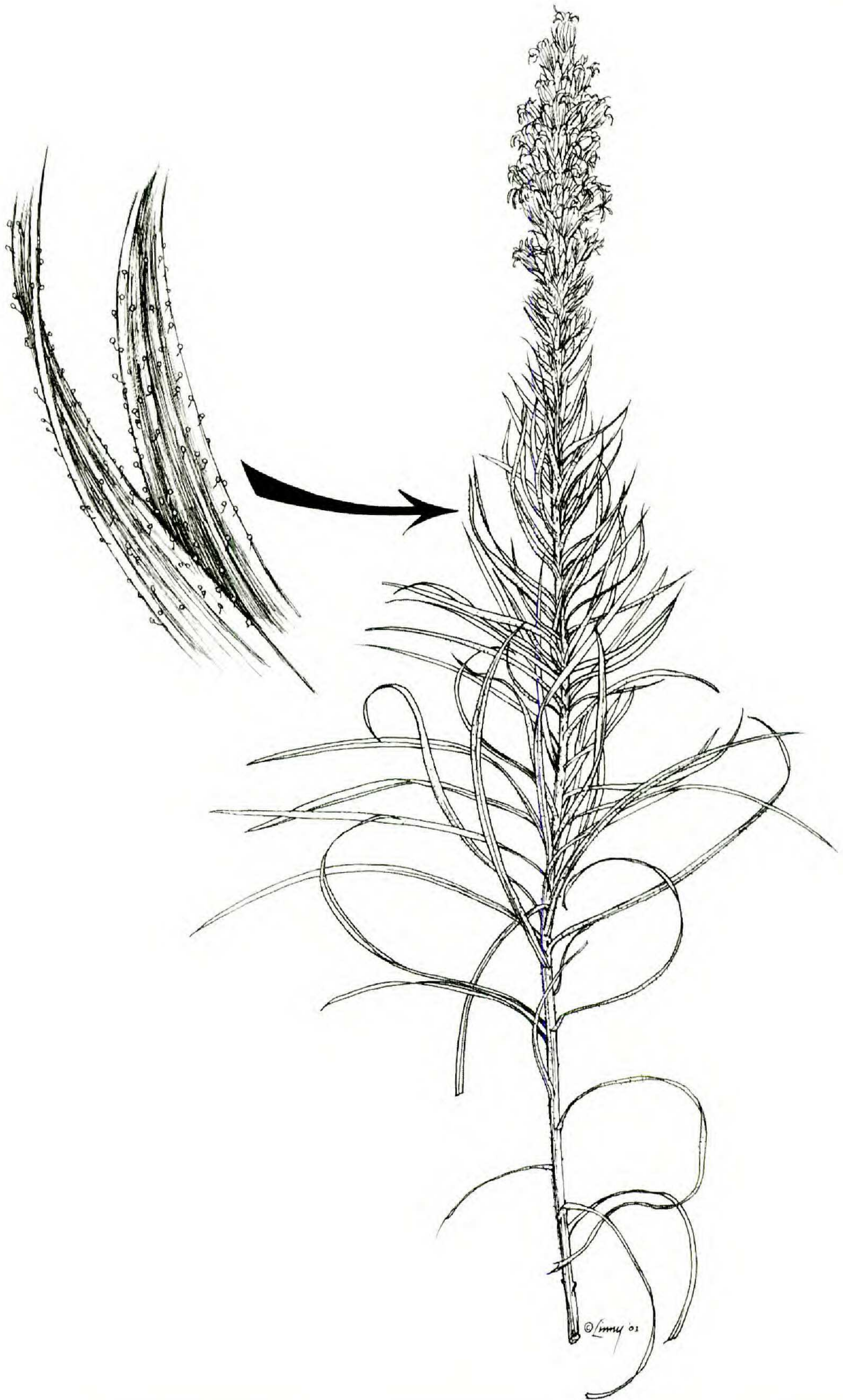


Fig. 3. Habit and details of *Liatris glandulosa* (from the type collection).



Fig. 4. Habit of *Liatris glandulosa*.

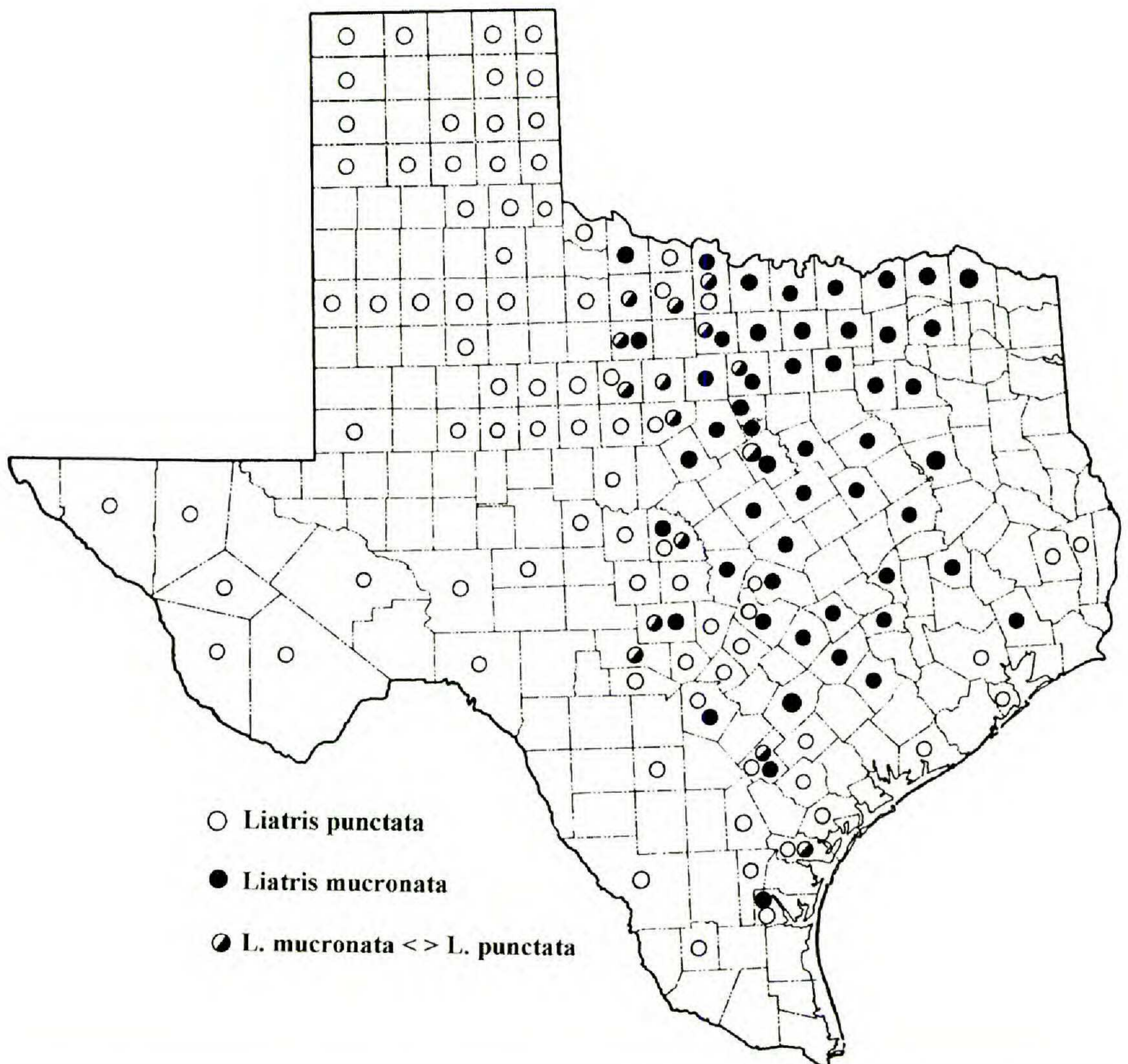


FIG. 5. Distribution of *Liatris mucronata* and *L. punctata* in Texas, including putative intermediates between these two taxa. Distinctions between varieties in *L. punctata* (var. *nebraskensis* Gaiser and var. *mexicana* Gaiser) and between varieties in *L. mucronata* (var. *mucronata* and var. *interrupta* Gaiser) are not made on this map.

southeast of the 1936 collection site by Gaiser (her collection 122)—this is a flat (probably artificially so), open field of about two acres with exposed limestone in some places. Numerous invasive plant species are abundant, and a large “for-sale” sign signals the close approach of ‘development’ of this lot and extirpation of the *Liatris* population. We collected most of these plants, taking corms for cultivation.

The Spring Creek site is a nature preserve that now protects the only known population of *Liatris glandulosa* in Dallas County. Here, the species grows in apparently natural habitats, and it also occurs in abundance in a ‘reconstituted’ substrate of mixed crushed limestone, gravel, and asphalt that filled a quarry and gravel pit site now located in a central portion of the preserve. This portion of the quarry was active until around 1988 (when acquired by Dallas County),



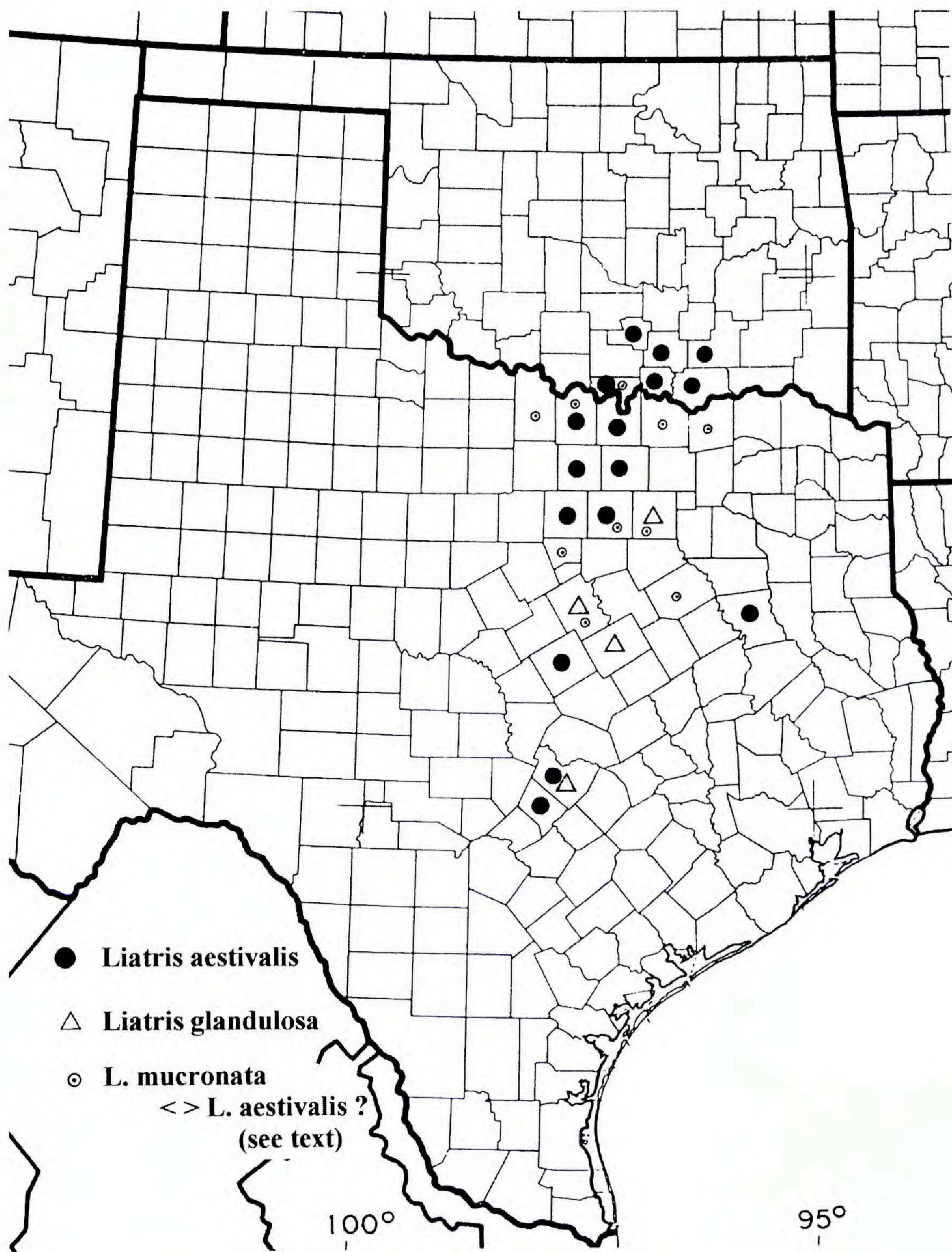


FIG. 6. Distribution of *L. aestivalis* and *L. glandulosa*. Localities for putative intermediates between *L. aestivalis* and *L. mucronata* also are shown.

so the revegetation (including *Liatris* recolonization) apparently has occurred within the last 12 years, lending optimism that *L. glandulosa* may be successfully sustained at Spring Creek and propagated elsewhere.

In the previously quarried area at Spring Creek (E side of Holford Road), with the plants of *Liatris glandulosa*, these species were common: *Yucca arkansana*, *Asclepias asperula*, *Hedeoma reverchonii*, *Heliotropium tenellum*, *Hedyotis nigricans*, *Paronychia virginica*, *Dalea multiflora*, *Pedomelum linearifolium*, *Eryngium leavenworthii*, *Mentzelia oligosperma*, *Grindelia lanceolata* var. *lanceolata*, *Hymenopappus scabiosaeus*, *Iva angustifolia*, and *Thelesperma filifolium*. *Liatris mucronata* (Nesom FW68) also is relatively common on the quarry fill, as well as other sites on deeper soil, but it was not yet in flower on 25 July, when the *L. glandulosa* was collected. Natural habitat adjacent to the old quarry site, encroached by *Juniperus virginiana*, *Cercis canadensis*, *Rhamnus caroliniana*, *Rhus trilobata*, harbors *L. glandulosa* and herbaceous species in addition to those above: *Schizachyrium scoparium*, *Sporobolus compositus* var. *drummondii*, *Krameria lanceolata*, *Eriogonum longifolium*, *Echinacea angustifolia*, and *Amphiachyris* sp. On a hilltop with exposed limestone (W side of Holford Road, about 1600 feet from the quarry site noted above), *L. glandulosa* grows with a similar set of species: *Yucca arkansana*, *Hedyotis nigricans*, *Heliotropium tenellum*, *Hedeoma reverchonii*, *Paronychia virginica*, *Eriogonum longifolium*, *Phyllanthus polygonoides*, *Stylingia texana*, *Toxicodendron radicans*, *Krameria lanceolata*, *Vernonia lindheimeri*, *Thelesperma filifolium*, *Echinacea angustifolia*, and *Amphiachyris* sp.; *Liatris mucronata* also is relatively common in deeper soil in this area (to the periphery of the *L. glandulosa* plants) but was not yet in flower on 25 July.

Spring Creek Forest Preserve is close to the northern boundary of Dallas County, suggesting that similar sites may still exist in adjacent Collin County. Habitats for *Liatris glandulosa* on the southwest side of Dallas County (Gaiser 122; Nesom FW75) are associated with the White Rock Escarpment, which extends southward. We will search for additional populations of the 'sticky gayfeather' in this area and in more southern counties and hope that Dallas-area naturalists will also do so.

### **Distinction of *Liatris glandulosa***

Plants of *Liatris glandulosa* have previously been identified as *L. mucronata*, but no other species of *Liatris* (across the whole genus) has a vestiture of stipitate-glandular hairs. Observation of these glandular plants growing sympatrically with *L. mucronata* and flowering far in advance of it indicates that two evolutionarily independent entities are present. There apparently is slight overlap in flowering time with *L. mucronata*, and some plants have been observed that suggest that limited gene flow occurs. These two species are distinguished by the following contrasts.

1. Stems and leaves densely stipitate-glandular, sticky to the touch; leaves relatively lax, ascending to loosely spreading or the lower deflexed; phyllaries 7–10(–12) per head, in 3–4 weakly graduate series, the outermost 1/2–2/3 the length of the inner, inner mostly oblong-lanceolate to lanceolate-triangular, broadly to narrowly acute at the apex, sometimes with an indurate mucro; florets 3–4(–5) per head; flowering mostly mid-July through early September \_\_\_\_\_ ***Liatris glandulosa***
1. Stems, leaves, and phyllaries strongly to weakly punctate, otherwise essentially glabrous or sparsely ciliate along the margins, not at all sticky; leaves stiffly spreading-ascending; phyllaries 11–15(–18) per head, in (4–)5–6 series strongly graduate in length, the outermost 1/3–1/5 the length of the inner, inner mostly oblong-obovate and obtuse to abruptly truncate-rounded at the apex, tipped by a thick, often spinulose mucro or cusp; florets (3–)4–5(–6) per head; flowering mostly mid-September through mid-October \_\_\_\_\_ ***Liatris mucronata***

We hypothesize that *Liatris glandulosa* and *L. aestivalis* have a sister relationship and that these two as a pair are most closely related to the northern segment of *L. mucronata*. Compared to 'southern' *L. mucronata*, the new species are both early-flowering and grow in a similar habitat, both are relatively restricted in geographic distribution, and they produce fewer-flowered capitula with fewer, weakly graduate phyllaries. Their geographic ranges are nearly contiguous—the populations of *L. glandulosa* in southwestern Dallas County are disjunct from closest *L. aestivalis* habitats in Tarrant County by an area of deep soil (Woodbine sand and Eagle Ford clay) without rock outcrops—or they may overlap southward. In addition to the difference in vestiture, plants of *L. aestivalis* differ from *L. glandulosa* in their narrower leaves and phyllaries that usually turn purple.

*Postscript.*—The question arises—how did these species escape the notice of Lloyd Shinnery, who lived, worked, and botanized in north central Texas? In a commentary on *Liatris mucronata*, Shinnery (1951) noted that “After observing and collecting the plants for five years, I fail to recognize two species [*L. angustifolia* and *L. mucronata*] as distinguished by Dr. Gaiser ...” Shinnery included *L. angustifolia* as a synonym of *L. mucronata* and observed that the latter is “very common in north central Texas in the wild, on a variety of soils (but commonest on limestone and chalk outcrops and calcareous prairies).” In this case, with all respect to the acuity of our predecessor, reality remained elusive. At least in part, he may have been led in his observations by Gaiser's diffuse morphological and geographical concept of *L. angustifolia* (narrowed here to *L. aestivalis*) and its distinction from *L. mucronata*. Shinnery collected *L. mucronata* from various habitats in 12 Texas counties, but there is only a single record of his collection of the earlier-flowering *L. aestivalis*—this from a Denton County plant far past flowering. Shinnery also examined the SMU collections of *L. glandulosa* and recorded (by annotation) involucre height, and V.L. Cory similarly recorded by annotation his observation that the plants were glandular, but neither botanist carried the investigation further.

We also note that, given the broader ecological range of *Liatris mucronata*, it certainly was once much more abundant than *L. aestivalis*, at least in the Fort Worth area. The most common habitat for *L. mucronata* is open, flat prairie—this habitat is easily turned to commercial and residential development and it has been. The relatively numerous cited collections of *L. aestivalis* from within the city of Fort Worth (where it is now more “common” than *L. mucronata*) reflect the persistence of scattered little plots of steep, rocky slope that have not yet been built upon. A few of these sites have been preserved within the city park system.

If the existence of *Liatris glandulosa* had been earlier recognized, it might or might not have prevented the apparent destruction of most of the species’ habitat in Dallas County. The value of preservation of natural sites is emphasized by the present example, where the only known extant population of *L. glandulosa* exists in areas of a relatively small park (83 acres) preserved within the city of Garland as part of the Dallas County Park and Open Space Program. The park was created to protect the old-growth forest that occurs there—preservation of the prairie patches harboring the rare *Liatris* was not a central concern.

#### ACKNOWLEDGMENTS

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